CLAIMS

1. Cyclodextrin derivative corresponding to formula (I):
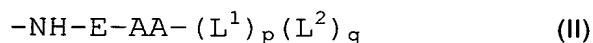

(I)
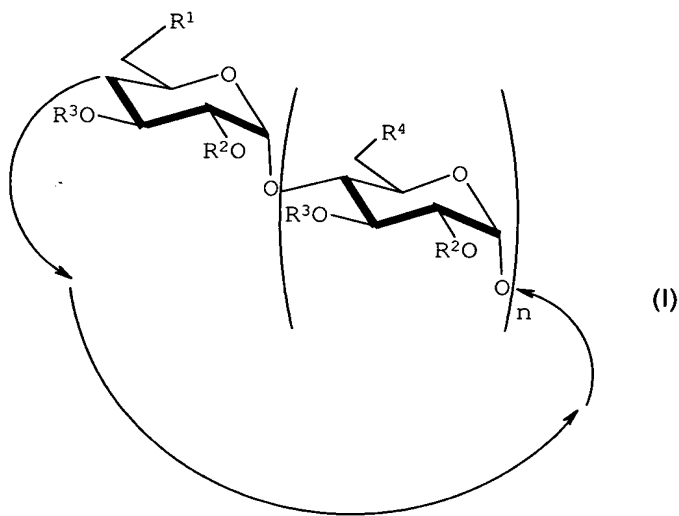
in which:

- R^1 corresponds to formula (II):

$$-NH-E-AA-(L^1)_p(L^2)_q \qquad (II)$$

in which:

- E represents a linear or branched, saturated or unsaturated hydrocarbon-based group comprising from 1 to 15 carbon atoms and optionally comprising one or more hetero atoms;

- AA represents the residue of an amino acid;

- L^1 and L^2, which may be identical or different, represent a linear, branched and/or cyclic, saturated or unsaturated hydrocarbon-based group

comprising from 6 to 24 carbon atoms and optionally comprising one or more hetero atoms;

- • p and q, which may be identical or different, are integers equal to 0 or to 1, on the condition however that at least one of these integers is other than 0;

- R^2 represents a hydrogen atom, a methyl group, an isopropyl group, a hydroxypropyl group or a sulphobutyl ether group;

- R^3 represents a hydrogen atom or is identical to R^2, except when R^2 is a hydroxypropyl group;

- all the R^4 represent either a hydroxyl group, or R^2, except when R^2 is a hydroxypropyl group, or else one or more R^4 are identical to R^1 and the other R^4 represent(s) either a hydroxyl group, or R^2, except when R^2 is a hydroxypropyl group;

- n is an integer equal to 5, 6 or 7.

2. Derivative according to Claim 1, in which, in formula (II), E corresponds to formula (III): $-CO-X-G^1-$, in which X represents a bridge-forming alkylene group comprising 1 to 8 carbon atoms, while G^1 represents a -CO-, -NH- or -NR- group in which R is a C_1 to C_6 alkyl group.

3. Derivative according to Claim 2, in which, in formula (III), X represents a bridge-forming alkylene group comprising from 1 to 4 carbon atoms, and preferably 2 carbon atoms.

4. Derivative according to any one of Claims 1 to 3, in which, in formula (II), AA represents the residue of an amino acid chosen from aspartic acid, glutamic acid, alanine, arginine, asparagine, cysteine, glutamine, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tyrosine, tryptophan and valine.

5. Derivative according to Claim 4, in which, in formula (II), AA represents the residue of an amino acid chosen from aspartic acid, glutamic acid, isoleucine, leucine and phenylalanine, and, preferably from aspartic acid and glutamic acid.

6. Derivative according to any one of the preceding claims, in which, in formula (II), AA represents the residue of an amino acid belonging to the L series.

7. Derivative according to any one of the preceding claims, in which, in formula (II), L^1 and L^2 correspond to formula (IV): $-G^2-Y$, in which G^2 represents a $-CO-$, $-NH-$ or $-NR-$ group where R is an C_1 to C_6 alkyl group, while Y represents a C_8 to C_{18} linear alkyl chain or a cyclic or polycyclic group that is lipophilic.

8. Derivative according to Claim 7, in which, in formula (IV), Y represents a C_{12} to C_{16} alkyl chain.

9. Derivative according to any one of the preceding claims, in which, in formula (II), E is bonded via an amide bond to the residue AA, this residue being itself bonded via an amide bond to the group(s) L^1 and/or L^2.

10. Derivative according to one of the preceding claims, in which, in formula (II), E corresponds to the formula: $-CO-X-CO-$ in which X has the same meaning as above, while L^1 and L^2 correspond to the formula: $-NH-Y$ in which Y has the same meaning as above.

11. Derivative according to any one of the preceding claims, in which, in formula (I), R^1 corresponds to the specific formula (VI):

(VI)
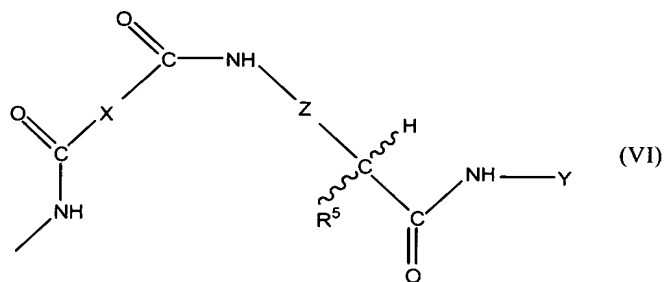
in which:

— X and Y have the same meaning as above; while

— Z represents:

• either a covalent bond, in which case R^5 represents a hydrogen atom, a methyl group, the side chain of an amino acid or a group of

formula: $-(CH_2)_t-CO-NH-Y$ in which t is 1 or 2 and Y has the same meaning as above,

- or a bridge-forming hydrocarbon-based group, comprising from 1 to 4 carbon atoms and comprising one or more hetero atoms chosen from O and N, in which case R^5 represents a primary amine group or a group of formula: $-NH-CO-Y$ in which Y has the same meaning as above.

12. Derivative according to Claim 11, in which, in formula (VI):

- Z represents a covalent bond;
- Y preferably represents a C_8 to C_{18}, and better still C_{12} to C_{16}, linear alkyl chain;
while
- R^5 represents a branched alkyl group containing 4 carbon atoms, a benzyl group or a group of formula: $-(CH_2)_t-CO-NH-Y$, in which t is equal to 1 or 2 and Y preferably represents a C_8 to C_{18}, and better still C_{12} to C_{16}, linear alkyl chain.

13. Derivative according to Claim 11 or Claim 12, in which, in formula (VI):

- Z represents a covalent bond;
- Y preferably represents a C_8 to C_{18}, and better still C_{12} to C_{16}, linear alkyl chain;
while
- R^5 represents a group of formula: $-(CH_2)_t-CO-NH-Y$, in which t is equal to 1 or 2 and Y preferably represents a C_8 to C_{18}, and better still C_{12} to C_{16}, linear alkyl chain.

14. Derivative according to any one of the preceding claims, which comprises only one substituent R^1 per molecule of derivative.

15. Derivative according to any one of the preceding claims, in which, in formula (I), n is equal to 6.

16. Derivative according to any one of the preceding claims, which is chosen from:

- N',N''-didodecyl-N_α-(6^I-amidosuccinyl-6^I-deoxycyclomaltoheptaose)-L-aspartamide,
- N',N''-didodecyl-N_α-(6^I-amidosuccinyl-6^I-deoxycyclomaltoheptaose)-L-glutamide,
- N',N''-didodecyl-N_α-(6^I-amidosuccinyl-6^I-deoxy-2^I-O-methylhexakis(2^{II-VII},6^{II-VII}-di-O-methyl)cyclomaltoheptaose)-L-aspartamide,
- N',N''-didodecyl-N_α-(6^I-amidosuccinyl-6^I-deoxy-2^I-O-methylhexakis(2^{II-VII},6^{II-VII}-di-O-methyl)cyclomaltoheptaose)-L-glutamide,
- N',N''-didodecyl-N_α-(6^I-amidosuccinyl-6^I-deoxy-2^I,3^I-di-O-methylhexakis(2^{II-VII},3^{II-VII},6^{II-VII}-tri-O-methyl)cyclomaltoheptaose)-L-aspartamide,
- N'-dodecyl-N''-hexadecyl-N_α-(6^I-amidosuccinyl-6^I-deoxycyclomaltoheptaose)-L-aspartamide,
- N',N''-didodecyl-N_α-(6^I-amidosuccinyl-6^I-deoxy-2^I,3^I-di-O-methylhexakis(2^{II-VII},3^{II-VII},6^{II-VII}-tri-O-methyl)cyclomaltoheptaose)-L-glutamide,

- N', N''-dihexadecyl-N_α-(6^I-amidosuccinyl-6^I-deoxy-$2^I, 3^I$-di-O-methylhexakis($2^{II-VII}, 3^{II-VII}, 6^{II-VII}$-tri-$O$-methyl)cyclomaltoheptaose)-L-aspartamide, and

- N'-dodecyl-N_α-(6^I-amidosuccinyl-6^I-deoxy-$2^I, 3^I$-di-O-methylhexakis($2^{II-VII}, 3^{II-VII}, 6^{II-VII}$-tri-$O$-methyl)cyclomaltoheptaose)-L-leucinamide.

17. Process for preparing a cyclodextrin derivative according to any one of Claims 1 to 16, which comprises a step in which a cyclodextrin derivative of formula (VII):
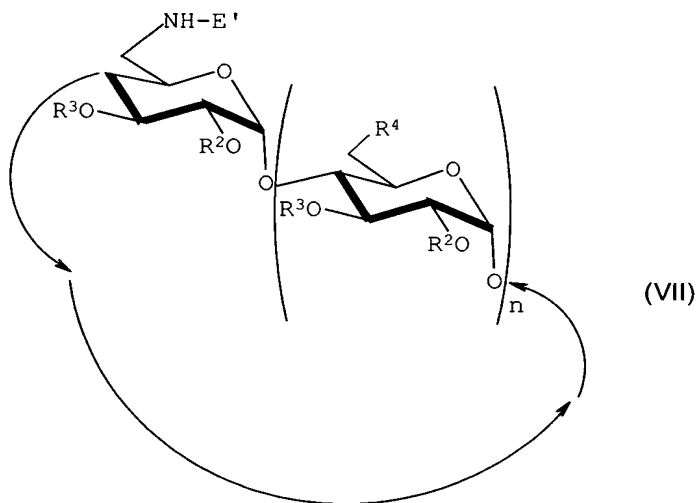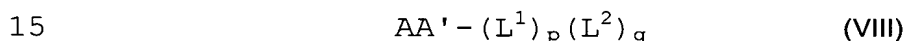

(VII)

in which:

— E' represents a linear or branched, saturated or unsaturated hydrocarbon-based group, comprising from 1 to 15 carbon atoms, one or more hetero atoms and a free functional group capable of reacting with a hydroxyl, amine, carboxylic acid or thiol group of an amino acid so as to form a covalent bond;

- R^2 represents a hydrogen atom, a methyl group, an isopropyl group, a hydroxypropyl group or a sulphobutyl ether group;

- R^3 represents a hydrogen atom or is identical to R^2,

5 except when R^2 is a hydroxypropyl group;

- all the R^4 represent either a hydroxyl group, or R^2, except when R^2 is a hydroxypropyl group, or else one or more R^4 represent an —NH-E' group and the other R^4 represent(s) either a hydroxyl group, or R^2, except

10 when R^2 is a hydroxypropyl group;

- n is an integer equal to 5, 6 or 7;

is reacted with a compound of formula (VIII):

15 $$AA' - (L^1)_p (L^2)_q \qquad \text{(VIII)}$$

in which:

- AA' represents an amino acid comprising a free hydroxyl, amine, carboxylic acid or thiol group;

20 - L^1 and L^2, which may be identical or different, represent a linear, branched and/or cyclic, saturated or unsaturated hydrocarbon-based group comprising from 6 to 24 carbon atoms and, optionally, comprising one or more hetero atoms;

25 - p and q, which may be identical or different, are integers equal to 0 or to 1, on the condition however that at least one of these integers is other than 0.

18. Process according to Claim 17, which also comprises a step consisting in reacting a monoamine cyclodextrin derivative of formula (IX):


(IX)
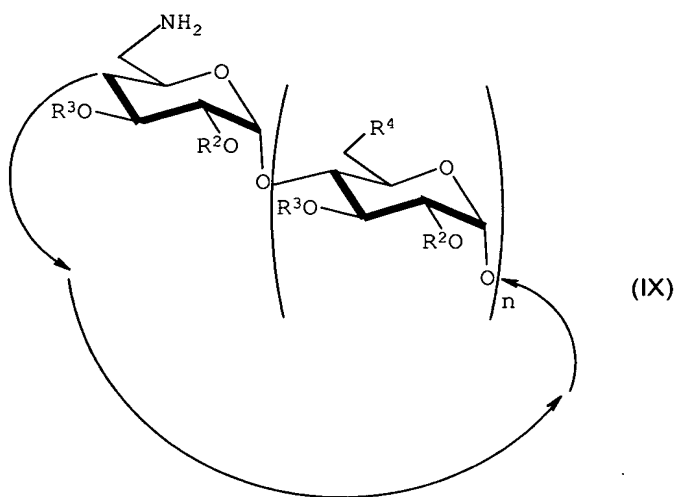
in which:

— R^2, R^3 and n have the same meaning as in formula (VII);

— all the R^4 represent either a hydroxyl group, or R^2, except when R^2 is a hydroxypropyl group, or else one or more R^4 represent(s) an $-NH_2$ group and the other R^4 represent(s) either a hydroxyl group, or R^2, except when R^2 is a hydroxypropyl group, with a compound that is a precursor of the group E' comprising a free functional group capable of reacting with the amine group of the derivative of formula (IX), so as to obtain the cyclodextrin derivative of formula (VII).

19. Process according to Claim 17, which also comprises the steps consisting in:

    — reacting an amino acid, in which the functional group intended to react with the free functional group of the group E' of the cyclodextrin derivative of formula (VII) has been protected beforehand, with a compound that is a precursor of the group L^1 and/or a compound that is a precursor of the group L^2, this or these precursor compound(s) comprising a free functional group capable of reacting with a hydroxyl, amine, carboxylic acid or thiol group of an amino acid so as to form a covalent bond; then

    — deprotecting the protected functional group of the amino acid,
so as to obtain the compound of formula (VIII).

    20. Process according to Claim 18, in which the compound that is a precursor of the group E' is an acid anhydride of formula (X):

                     (X)
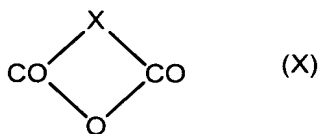
in which X has the same meaning as above, which is reacted with the monoamine cyclodextrin derivative of formula (IX) in an anhydrous medium and under an inert atmosphere.

    21. Process according to any one of Claims 17 to 20, in which the cyclodextrin derivative of formula (VII) and the compound of formula (VIII) are

reacted in the presence of N,N'-diisopropylcarbodiimide (DIC) and hydroxybenzotriazole (HOBT).

22. Inclusion complex of a cyclodextrin derivative according to any one of Claims 1 to 16, and a hydrophobic compound.

23. Inclusion complex according to Claim 22, in which the hydrophobic compound is a medicinal active ingredient.

24. Inclusion complex according to Claim 22, in which the hydrophobic compound is a cell membrane detergent.

25. Organized surfactant system comprising a cyclodextrin derivative according to any one of Claims 1 to 16 or an inclusion complex according to any one of Claims 22 to 24.

26. Organized surfactant system according to Claim 25, in which the surfactant is a phospholipid.